


**PRELIMINARY
HYDROLOGY STUDY
FOR
QUEEN OF ANGELS CHURCH
ALPINE, CALIFORNIA**

June 2002 (First Submittal)
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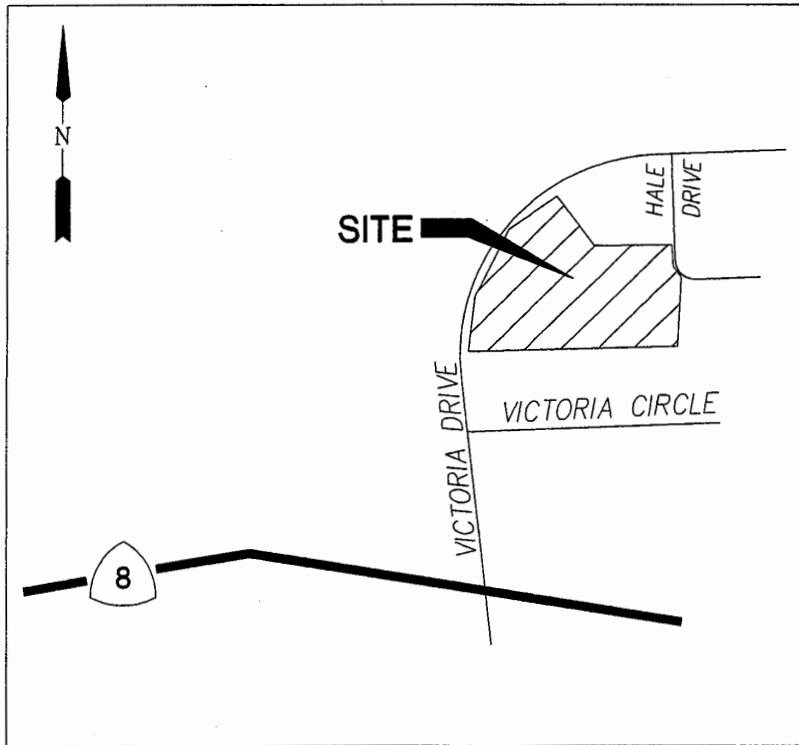
I. INTRODUCTION

The Queen of Angels site is located in the unincorporated area of Alpine, in the County of San Diego, approximately 2.0 miles north of the intersections of Highway 8 and Victoria Drive. The site fronts West Victoria Drive to the west and north and Hale Drive to the east. Currently, the approximately 8.5-acre site is an undeveloped lot, with the exception of an existing church on the southwest corner of the property.

The project proposes to construct a new church facility with additional hall/office buildings, surrounded by parking and landscaping. The development of the site will require the construction of drainage facilities to convey storm runoff into the existing earthen channel located within the southerly portion of the site. The intent of this drainage study is to examine the effect of the proposed development and examine the onsite storm flows into the existing earthen channel.

II. PROJECT DESCRIPTION

This project proposes to convey onsite storm runoff through the proposed storm drain system and release the flows into existing earthen channels. Field observations were conducted to determine the existing conditions with respect to estimating the quantity of storm water actually captured. An analysis of the existing conditions indicated that the site is located at the peak of the contributing drainage basin. Although some offsite runoff will contribute to flows in the channel, in comparison to the onsite runoff, the offsite flows are minimal. The majority of the flows contributing to the existing channel will be conveyed from the site.



VICINITY MAP

NO SCALE

EXISTING CONDITIONS

Currently the undeveloped lot allows storm runoff to sheet flow across the property, which is then captured in earthen drainage swales running north to south. Storm runoff from half of Victoria Drive is also conveyed through the property and is eventually captured in the earthen swales.

PROPOSED CONDITIONS

The developed site proposes to convey onsite and offsite storm flows through curb and gutter systems to be captured by catch basins located throughout the site. Pipes will be proposed to convey storm runoff into the existing earthen channels located along the south end of the site.

III. METHODOLOGY

HYDROLOGY METHODOLOGY

A 100-year storm events analysis was conducted using the methodology described in the County of San Diego Hydrology Manual for both the developed and undeveloped site. The rational method was used to determine the flow contributions from each basin. (See Exhibit "A", Exhibit "B", and Appendix A.) It was determined that the undeveloped site will convey approximately 27 CFS to the southwestern earthen channel and 7 CFS to the southeastern channel, for the 100-year event. The developed site will convey approximately 29 CFS to the southwestern earthen channel and 7 CFS to the southeastern earthen channel, for the 100-year storm event.

HYDRAULIC DESIGN

Further analysis of the onsite systems will be conducted upon final design of the proposed onsite facilities.

Summary of Pre-and Post-Development Conditions

(See Calculations and Exhibit in Appendix 'A')

Area A		Area (Acres)	Q ₁₀₀ (CFS)	T _c (Minutes)
Pre-Development	Basin A	8.8	20.1	12.9
Post-Development	Basin AA	8.8	22.1	15.8

Basin AA consists of Subbasins A, B, and 1-13, which outlet at Node 117, with an area of approximately 8.8 acres..

Area B		Area (Acres)	Q ₁₀₀ (CFS)	T _c (Minutes)
Pre-Development	Basin B	3.2	7.1	13.6
Post-Development	Basin BB	3.2	7.1	14.3

Basin BB consists of Subbasins C, 14, and offsite, which outlet at Node 205, with an area of approximately 2.3 acres.

Total	Area (Acres)	Q ₁₀₀ (CFS)	T _c (Minutes)
Pre-Development	12.0	27	12.9
Post-Development	12.0	29	15.8

IV. CONCLUSION

The rational method was used to calculate the total flow (Q_{100}) at the downstream points for the developed and undeveloped basins. Based on topographic information obtained from the County of San Diego, the undeveloped basins were conveying a total of approximately 27 CFS. The analysis of the developed basins determined that the proposed basins would convey a total of approximately 29 CFS.

Due to the development of the surrounding areas, the total basin area contributing flows to the southwestern earthen channel has not been increased, but the runoff flows developed in the basin increased by approximately 2.0 CFS. A detention basin is proposed at the outlet of this system to reduce the peak flow rate and make it equal to the predeveloped flow. See Appendix B of this report for detention basin calculations.

The development of the site does not increase the basin area introduced to the southeastern earthen channel and also does not increase flows introduced to the southeastern earthen channel due to the confluence factoring. The development of the site does not propose any diversion of existing flows that would adversely impact the downstream wetlands or riparian habitats.

APPENDIX “A”

EXISTING HYDROLOGY

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-1999 Version 6.1

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
Rational Hydrology Study Date: 04/21/03

Queen of Angels Church
Job No. 175549
Existing Hydrology

***** Hydrology Study Control Information *****

P & D Consultants, San Diego, California - S/N 558

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used
English (in) rainfall data used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 6.700
Adjusted 6 hour precipitation (inches) = 3.200
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

User specified 'C' value of 0.500 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = $[11.9 * \text{length}(\text{Mi})^3 / (\text{elevation change}(\text{Ft.}))]^{.385} * 60(\text{min/hr}) + 10$

min.

Initial subarea flow distance = 800.000(Ft.)
Highest elevation = 2160.000(Ft.)
Lowest elevation = 2055.000(Ft.)
Elevation difference = 105.000(Ft.)
TC = $[(11.9 * 0.1515^3) / (105.00)]^{.385} = 2.93 + 10 \text{ min.} = 12.93 \text{ min.}$
Rainfall intensity (I) = 4.567(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
Subarea runoff = 20.096(CFS)
Total initial stream area = 8.800(Ac.)

Process from Point/Station 1.000 to Point/Station 2.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
 Stream flow area = 8.800 (Ac.)
 Runoff from this stream = 20.096 (CFS)
 Time of concentration = 12.93 min.
 Rainfall intensity = 4.567 (In/Hr)
 Program is now starting with Main Stream No. 2

 Process from Point/Station 3.000 to Point/Station 2.000
 **** INITIAL AREA EVALUATION ****

User specified 'C' value of 0.500 given for subarea
 Time of concentration computed by the
 natural watersheds nomograph (App X-A)
 $TC = [11.9 * \text{length}(\text{Mi})^3 / (\text{elevation change}(\text{Ft.}))]^{.385} * 60 (\text{min/hr}) + 10$

min.

Initial subarea flow distance = 990.000 (Ft.)
 Highest elevation = 2160.000 (Ft.)
 Lowest elevation = 2040.000 (Ft.)
 Elevation difference = 120.000 (Ft.)
 $TC = [(11.9 * 0.1875^3) / (120.00)]^{.385} = 3.57 + 10 \text{ min.} = 13.57 \text{ min.}$
 Rainfall intensity (I) = 4.429 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
 Subarea runoff = 7.086 (CFS)
 Total initial stream area = 3.200 (Ac.)

 Process from Point/Station 3.000 to Point/Station 2.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 3.200 (Ac.)
 Runoff from this stream = 7.086 (CFS)
 Time of concentration = 13.57 min.
 Rainfall intensity = 4.429 (In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	20.096	12.93	4.567
2	7.086	13.57	4.429

Qmax(1) =
 $1.000 * 1.000 * 20.096) +$
 $1.000 * 0.954 * 7.086) + = 26.853$
 Qmax(2) =
 $0.970 * 1.000 * 20.096) +$
 $1.000 * 1.000 * 7.086) + = 26.574$

Total of 2 main streams to confluence:
 Flow rates before confluence point:
 20.096 7.086
 Maximum flow rates at confluence using above data:

26.853	26.574
Area of streams before confluence:	
8.800	3.200

Results of confluence:

Total flow rate = 26.853 (CFS)

Time of concentration = 12.934 min.

Effective stream area after confluence = 12.000 (Ac.)

End of computations, total study area = 12.000 (Ac.)

PROPOSED HYDROLOGY

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-1999 Version 6.1

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
Rational Hydrology Study Date: 04/21/03

Queen of Angels Church
Job No. 175549
Proposed Hydrology Calculation

***** Hydrology Study Control Information *****

P & D Consultants, San Diego, California - S/N 558

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used
English (in) rainfall data used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 6.700
Adjusted 6 hour precipitation (inches) = 3.200
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

+++++
Process from Point/Station 112.500 to Point/Station 112.000
**** INITIAL AREA EVALUATION ****

User specified 'C' value of 0.500 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = $[11.9 * \text{length}(\text{Mi})^3 / (\text{elevation change}(\text{Ft.}))]^{.385} * 60(\text{min/hr}) + 10$
min.

Initial subarea flow distance = 450.000(Ft.)
Highest elevation = 2147.000(Ft.)
Lowest elevation = 2094.000(Ft.)
Elevation difference = 53.000(Ft.)
TC = $[(11.9 * 0.0852^3) / (53.00)]^{.385} = 1.96 + 10 \text{ min.} = 11.96 \text{ min.}$
Rainfall intensity (I) = 4.803(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
Subarea runoff = 5.043(CFS)
Total initial stream area = 2.100(Ac.)

+++++
Process from Point/Station 112.000 to Point/Station 117.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 2094.000(Ft.)

Downstream point/station elevation = 2060.000(Ft.)
 Pipe length = 450.00(Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 5.043(CFS)
 Nearest computed pipe diameter = 12.00(In.)
 Calculated individual pipe flow = 5.043(CFS)
 Normal flow depth in pipe = 6.11(In.)
 Flow top width inside pipe = 12.00(In.)
 Critical Depth = 11.03(In.)
 Pipe flow velocity = 12.56(Ft/s)
 Travel time through pipe = 0.60 min.
 Time of concentration (TC) = 12.56 min.

++++++
 Process from Point/Station 112.000 to Point/Station 117.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 2.100(Ac.)
 Runoff from this stream = 5.043(CFS)
 Time of concentration = 12.56 min.
 Rainfall intensity = 4.654(In/Hr)

++++++
 Process from Point/Station 101.500 to Point/Station 101.000
 **** INITIAL AREA EVALUATION ****

User specified 'C' value of 0.650 given for subarea
 Initial subarea flow distance = 220.000(Ft.)
 Highest elevation = 2124.000(Ft.)
 Lowest elevation = 2121.500(Ft.)
 Elevation difference = 2.500(Ft.)
 Time of concentration calculated by the urban
 areas overland flow method (App X-C) = 11.51 min.
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (\% slope^{(1/3)})$
 $TC = [1.8 * (1.1 - 0.6500) * (220.000^{.5})] / (1.136^{(1/3)}) = 11.51$
 Rainfall intensity (I) = 4.923(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.650
 Subarea runoff = 1.280(CFS)
 Total initial stream area = 0.400(Ac.)

++++++
 Process from Point/Station 101.000 to Point/Station 117.000
 **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 2110.000(Ft.)
 End of street segment elevation = 2060.000(Ft.)
 Length of street segment = 600.000(Ft.)
 Height of curb above gutter flowline = 6.0(In.)
 Width of half street (curb to crown) = 20.000(Ft.)
 Distance from crown to crossfall grade break = 18.500(Ft.)
 Slope from gutter to grade break (v/hz) = 0.080
 Slope from grade break to crown (v/hz) = 0.020
 Street flow is on [2] side(s) of the street
 Distance from curb to property line = 10.000(Ft.)

Slope from curb to property line (v/hz) = 0.020
 Gutter width = 1.500 (Ft.)
 Gutter hike from flowline = 2.000 (In.)
 Manning's N in gutter = 0.0200
 Manning's N from gutter to grade break = 0.0200
 Manning's N from grade break to crown = 0.0500
 Estimated mean flow rate at midpoint of street = 7.680 (CFS)
 Depth of flow = 0.385 (Ft.), Average velocity = 2.333 (Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width = 12.424 (Ft.)
 Flow velocity = 2.33 (Ft/s)
 Travel time = 4.29 min. TC = 15.80 min.
 Adding area flow to street
 User specified 'C' value of 0.650 given for subarea
 Rainfall intensity = 4.014 (In/Hr) for a 100.0 year storm
 Runoff coefficient used for sub-area, Rational method, $Q=KCIA$, $C = 0.650$
 Subarea runoff = 10.437 (CFS) for 4.000 (Ac.)
 Total runoff = 11.717 (CFS) Total area = 4.40 (Ac.)
 Street flow at end of street = 11.717 (CFS)
 Half street flow at end of street = 5.859 (CFS)
 Depth of flow = 0.432 (Ft.), Average velocity = 2.565 (Ft/s)
 Flow width (from curb towards crown) = 14.770 (Ft.)

++++++
 Process from Point/Station 101.000 to Point/Station 117.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 4.400 (Ac.)
 Runoff from this stream = 11.717 (CFS)
 Time of concentration = 15.80 min.
 Rainfall intensity = 4.014 (In/Hr)

++++++
 Process from Point/Station 202.000 to Point/Station 113.000
 **** INITIAL AREA EVALUATION ****

User specified 'C' value of 0.650 given for subarea
 Initial subarea flow distance = 150.000 (Ft.)
 Highest elevation = 2102.000 (Ft.)
 Lowest elevation = 2100.000 (Ft.)
 Elevation difference = 2.000 (Ft.)
 Time of concentration calculated by the urban
 areas overland flow method (App X-C) = 9.01 min.
 $TC = [1.8 * (1.1 - C) * distance (Ft.)^{.5}] / (\% slope^{(1/3)})$
 $TC = [1.8 * (1.1 - 0.6500) * (150.000^{.5})] / (1.333^{(1/3)}) = 9.01$
 Rainfall intensity (I) = 5.765 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area ($Q=KCIA$) is $C = 0.650$
 Subarea runoff = 1.124 (CFS)
 Total initial stream area = 0.300 (Ac.)

++++++
 Process from Point/Station 113.000 to Point/Station 117.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 2096.000 (Ft.)
 Downstream point/station elevation = 2060.000 (Ft.)
 Pipe length = 550.00 (Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 1.124 (CFS)
 Nearest computed pipe diameter = 6.00 (In.)
 Calculated individual pipe flow = 1.124 (CFS)
 Normal flow depth in pipe = 4.00 (In.)
 Flow top width inside pipe = 5.66 (In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 8.09 (Ft/s)
 Travel time through pipe = 1.13 min.
 Time of concentration (TC) = 10.15 min.

++++++
 Process from Point/Station 113.000 to Point/Station 117.000
 **** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.650 given for subarea
 Time of concentration = 10.15 min.
 Rainfall intensity = 5.341 (In/Hr) for a 100.0 year storm
 Runoff coefficient used for sub-area, Rational method, $Q=KCIA$, $C = 0.650$
 Subarea runoff = 6.944 (CFS) for 2.000 (Ac.)
 Total runoff = 8.068 (CFS) Total area = 2.30 (Ac.)

++++++
 Process from Point/Station 113.000 to Point/Station 117.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 3

Stream flow area = 2.300 (Ac.)
 Runoff from this stream = 8.068 (CFS)
 Time of concentration = 10.15 min.
 Rainfall intensity = 5.341 (In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	5.043	12.56	4.654
2	11.717	15.80	4.014
3	8.068	10.15	5.341
Qmax (1) =			
	1.000 *	1.000 *	5.043) +
	1.000 *	0.795 *	11.717) +
	0.871 *	1.000 *	8.068) + =
			21.389
Qmax (2) =			
	0.862 *	1.000 *	5.043) +
	1.000 *	1.000 *	11.717) +
	0.752 *	1.000 *	8.068) + =
			22.130
Qmax (3) =			
	1.000 *	0.808 *	5.043) +
	1.000 *	0.642 *	11.717) +
	1.000 *	1.000 *	8.068) + =
			19.666

Total of 3 streams to confluence:
 Flow rates before confluence point:
 5.043 11.717 8.068
 Maximum flow rates at confluence using above data:
 21.389 22.130 19.666
 Area of streams before confluence:
 2.100 4.400 2.300
 Results of confluence:
 Total flow rate = 22.130 (CFS)
 Time of concentration = 15.799 min.
 Effective stream area after confluence = 8.800 (Ac.)

+++++
 Process from Point/Station 117.000 to Point/Station 117.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
 Stream flow area = 8.800 (Ac.)
 Runoff from this stream = 22.130 (CFS)
 Time of concentration = 15.80 min.
 Rainfall intensity = 4.014 (In/Hr)
 Program is now starting with Main Stream No. 2

+++++
 Process from Point/Station 201.500 to Point/Station 201.000
 **** INITIAL AREA EVALUATION ****

User specified 'C' value of 0.500 given for subarea
 Time of concentration computed by the
 natural watersheds nomograph (App X-A)
 $TC = [11.9 * \text{length}(\text{Mi})^3 / (\text{elevation change}(\text{Ft.}))]^{.385} * 60(\text{min/hr}) + 10$
 min.

Initial subarea flow distance = 500.000 (Ft.)
 Highest elevation = 2150.000 (Ft.)
 Lowest elevation = 2106.000 (Ft.)
 Elevation difference = 44.000 (Ft.)
 $TC = [(11.9 * 0.0947^3) / (44.00)]^{.385} = 2.38 + 10 \text{ min.} = 12.38 \text{ min.}$
 Rainfall intensity (I) = 4.697 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
 Subarea runoff = 1.644 (CFS)
 Total initial stream area = 0.700 (Ac.)

+++++
 Process from Point/Station 202.000 to Point/Station 205.000
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 3.640 (CFS)
 Depth of flow = 0.118 (Ft.), Average velocity = 3.412 (Ft/s)
 ***** Irregular Channel Data *****

Information entered for subchannel number 1 :
 Point number 'X' coordinate 'Y' coordinate

1	0.00	3.00
2	1.00	0.00
3	10.00	0.00
4	11.00	3.00

Manning's 'N' friction factor = 0.035

Sub-Channel flow = 3.640 (CFS)
 ' ' flow top width = 9.079 (Ft.)
 ' ' velocity = 3.412 (Ft/s)
 ' ' area = 1.067 (Sq.Ft)
 ' ' Froude number = 1.754

Upstream point elevation = 2088.000 (Ft.)
 Downstream point elevation = 2042.000 (Ft.)
 Flow length = 400.000 (Ft.)
 Travel time = 1.95 min.
 Time of concentration = 14.34 min.
 Depth of flow = 0.118 (Ft.)
 Average velocity = 3.412 (Ft/s)
 Total irregular channel flow = 3.640 (CFS)
 Irregular channel normal depth above invert elev. = 0.118 (Ft.)
 Average velocity of channel(s) = 3.412 (Ft/s)

Sub-Channel No. 1 Critical depth = 0.172 (Ft.)
 ' ' ' Critical flow top width = 9.115 (Ft.)
 ' ' ' Critical flow velocity = 2.339 (Ft/s)
 ' ' ' Critical flow area = 1.557 (Sq.Ft)

Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [RURAL(greater than 0.5 Ac, 0.2 ha) area type]
 Rainfall intensity = 4.274 (In/Hr) for a 100.0 year storm
 Runoff coefficient used for sub-area, Rational method, Q=KCIA, C = 0.450
 Subarea runoff = 3.269 (CFS) for 1.700 (Ac.)
 Total runoff = 4.913 (CFS) Total area = 2.40 (Ac.)

 Process from Point/Station 202.000 to Point/Station 205.000
 **** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.650 given for subarea
 Time of concentration = 14.34 min.
 Rainfall intensity = 4.274 (In/Hr) for a 100.0 year storm
 Runoff coefficient used for sub-area, Rational method, Q=KCIA, C = 0.650
 Subarea runoff = 2.222 (CFS) for 0.800 (Ac.)
 Total runoff = 7.136 (CFS) Total area = 3.20 (Ac.)

 Process from Point/Station 205.000 to Point/Station 117.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 3.200 (Ac.)
 Runoff from this stream = 7.136 (CFS)
 Time of concentration = 14.34 min.
 Rainfall intensity = 4.274 (In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	22.130	15.80	4.014
2	7.136	14.34	4.274

Qmax(1) =
 $1.000 * 1.000 * 22.130 + 0.939 * 1.000 * 7.136 + = 28.832$
 Qmax(2) =
 $1.000 * 0.907 * 22.130 + 1.000 * 1.000 * 7.136 + = 27.218$

Total of 2 main streams to confluence:

Flow rates before confluence point:

22.130 7.136

Maximum flow rates at confluence using above data:

28.832 27.218

Area of streams before confluence:

8.800 3.200

Results of confluence:

Total flow rate = 28.832 (CFS)

Time of concentration = 15.799 min.

Effective stream area after confluence = 12.000 (Ac.)

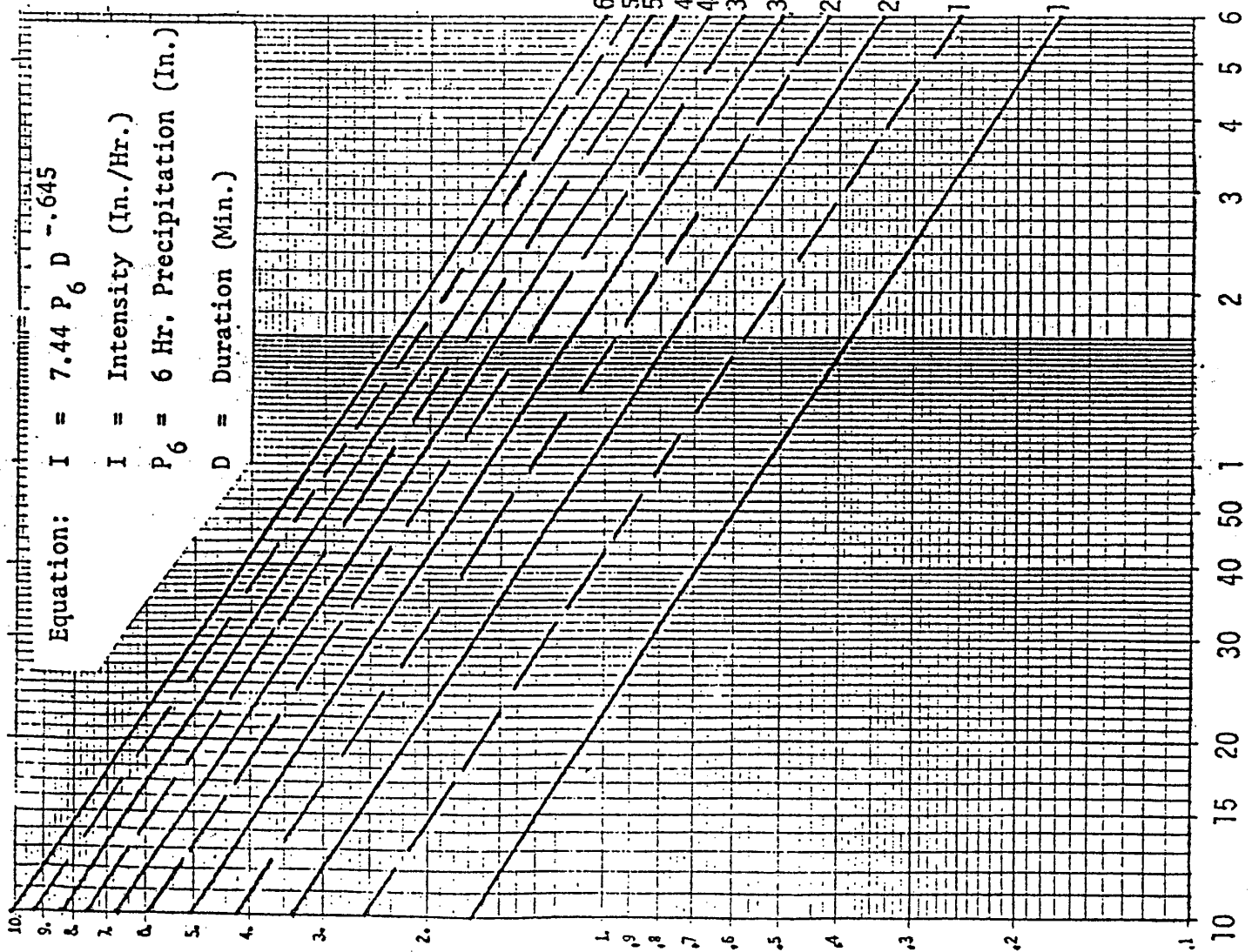
End of computations, total study area = 12.000 (Ac.)

Queen of Angels
Summary of Onsite Proposed Drainage Basins (Q₁₀₀)

Basin	Subarea (Acres)	Subtotal Area (Acres)	T_c (Minutes)	Q₁₀₀ (CFS)
1	0.45	6.7+/-	9.3	29.0
2	0.29			
3	0.33			
4	0.39			
5	0.46			
6	0.46			
7	0.15			
8	0.19			
9	0.32			
10	1.07			
11	0.28			
12	0.33			
13	1.95			
14	0.79	0.8	13.3	2.0
A	0.84	2.1	12.6	3.0
B	1.28			
C	0.71	0.7	12.4	3.0
Offsite Area	4.50	1.7	8.2	12.0

See Developed Condition Exhibit at the back of the report for area designation.

INTENSITY-DURATION DESIGN CHART



6-Hour Precipitation (inches)

Directions for Application:

- 1) From precipitation maps determine 6 hr. and 24 hr. amounts for the selected frequency. These maps are printed in the County Hydrolog. Manual (10, 50 and 100 yr. maps included in the Design and Procedure Manual).
- 2) Adjust 6 hr. precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr. precipitation. (Not applicable to Desert)
- 3) Plot 6 hr. precipitation on the right side of the chart.
- 4) Draw a line through the point parallel to the plotted lines.
- 5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

0) Selected Frequency 100 yr.

1) $P_6 = \underline{3.2}$ in., $P_{24} = \underline{6.7}$, $*P_6 = \underline{47.8}\%$

2) Adjusted $*P_6 = \underline{\hspace{2cm}}$ in.

3) $t_c = \underline{\hspace{2cm}}$ min.

4) $I = \underline{\hspace{2cm}}$ in/hr.

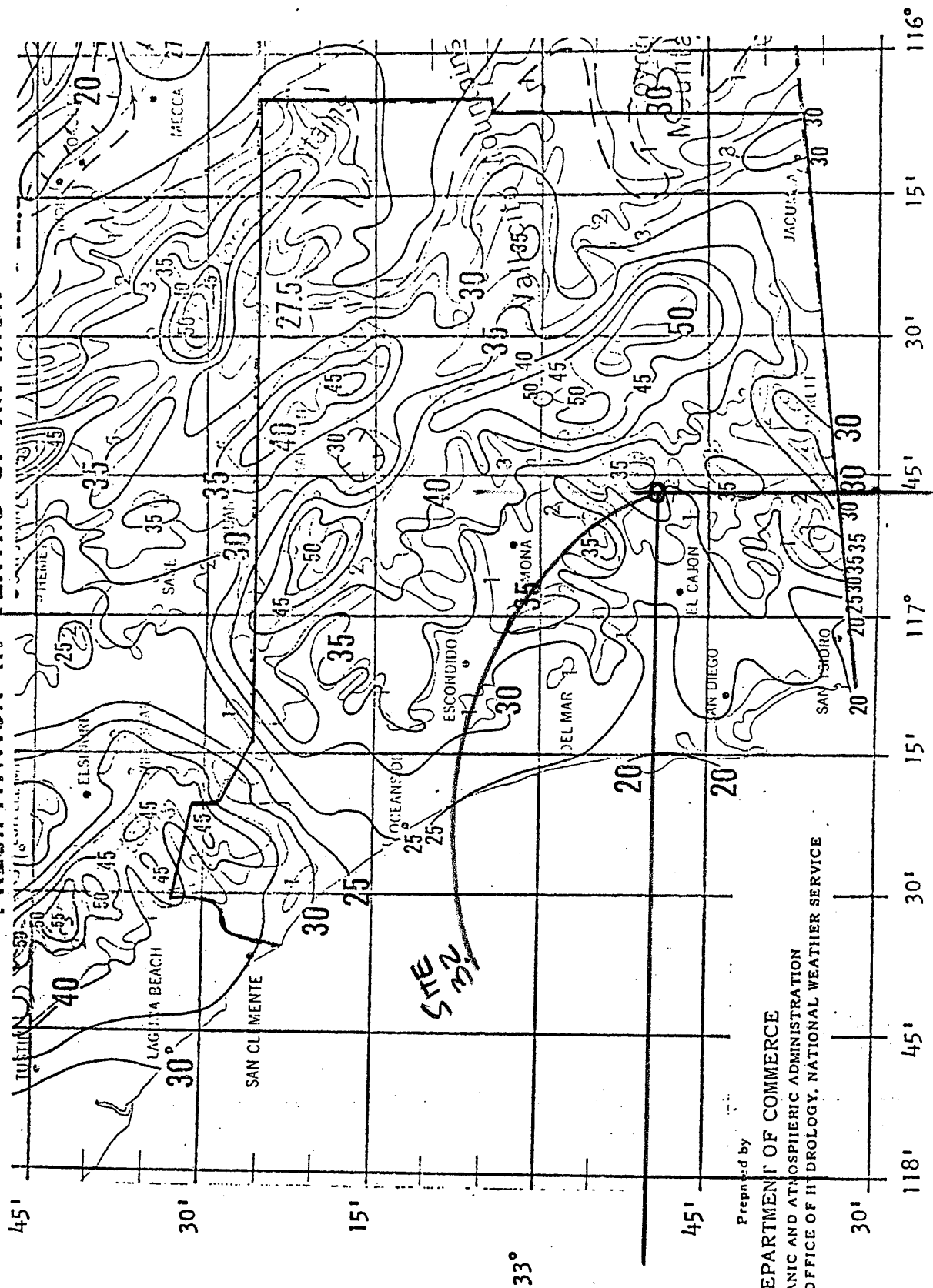
*Not Applicable to Desert Region

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION &
FLOOD CONTROL

100-YEAR 6-HOUR PRECIPITATION

20- ISOPLUVIALS OF 100-YEAR 6-HOUR

PRECIPITATION IN TENTHS OF AN INCH



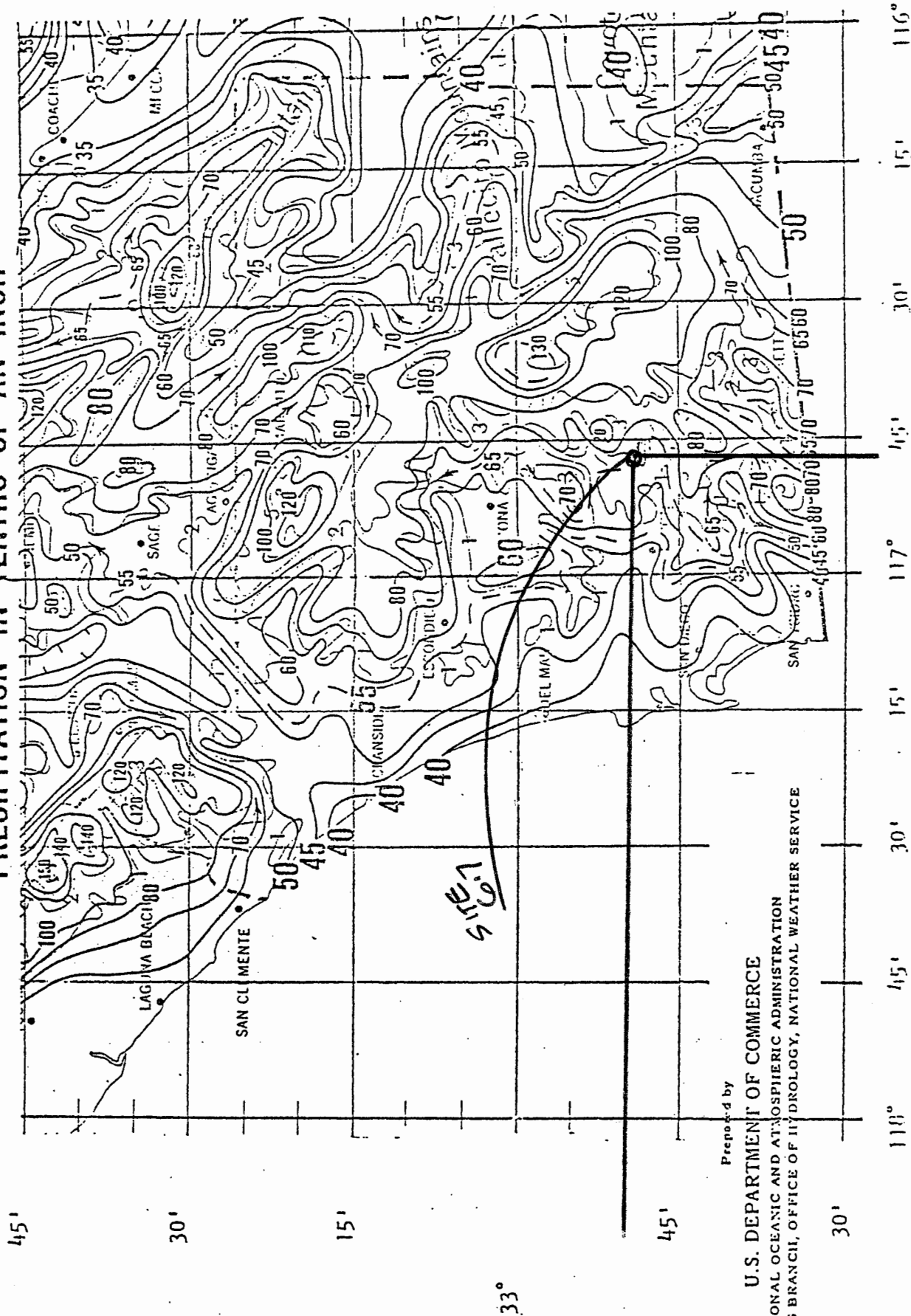
Prepared by
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
SPECIAL STUDIES BRANCH, OFFICE OF HYDROLOGY, NATIONAL WEATHER SERVICE

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION &
FLOOD CONTROL

100-YEAR 24-HOUR PRECIPITATION

20 ISOPLUVIALS OF 100-YEAR 24-HOUR

PRECIPITATION IN TENTHS OF AN INCH



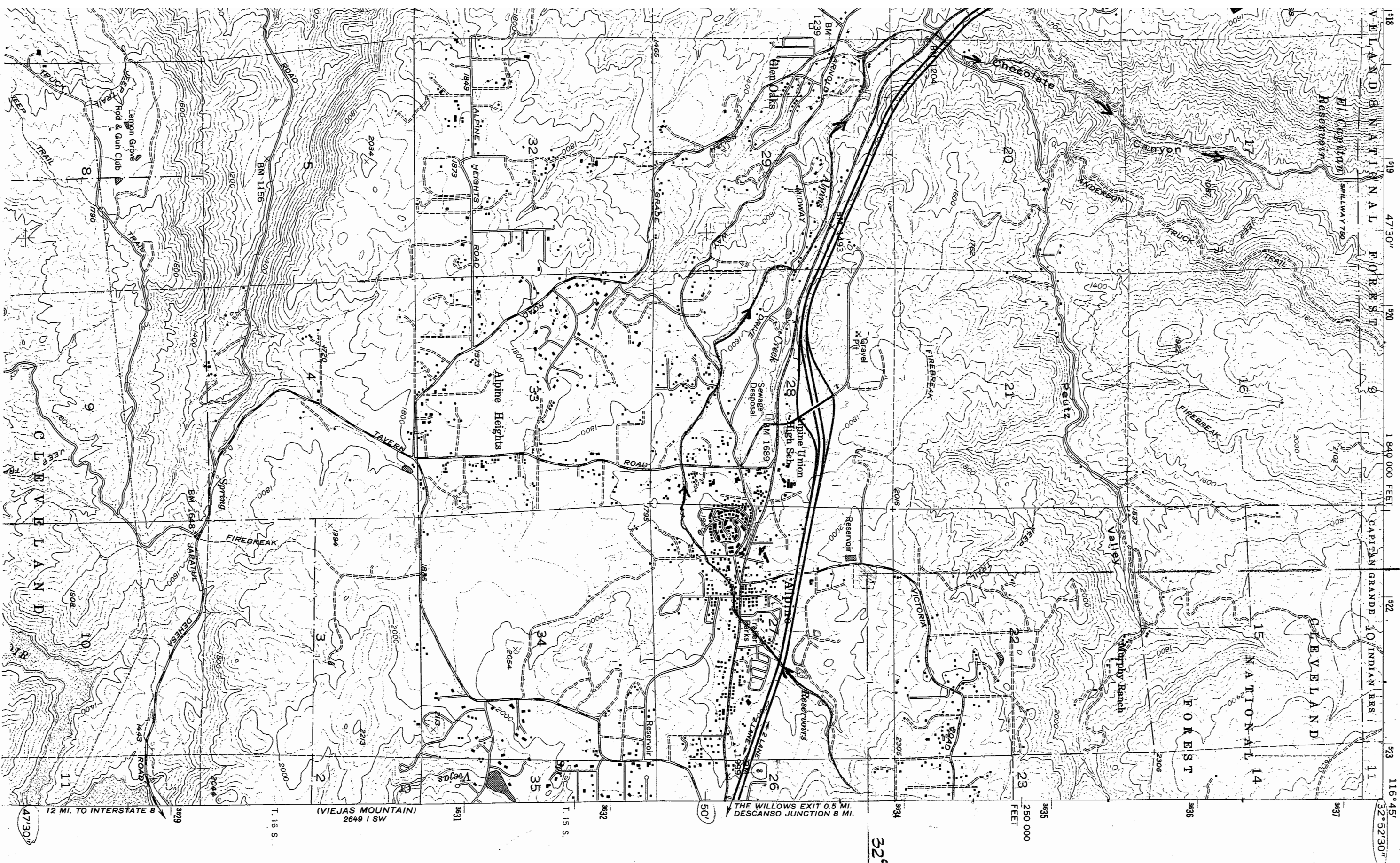
Prepared by
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
SPECIAL STUDIES BRANCH, OFFICE OF HYDROLOGY, NATIONAL WEATHER SERVICE

QUEEN OF ANGELS CHURCH
c 9/2002

116° 46' 00"

ALPINE QUADRANGLE
CALIFORNIA—SAN DIEGO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

2649 1 NW
(TULE SPRINGS)



32° 50' 36" ±

ALPINE
(64)

RUNOFF COEFFICIENTS (RATIONAL METHOD)

LAND USE	Coefficient, C Soil Group (1)			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Undeveloped	.30	.35	.40	.45
Residential:				
Rural	.30	.35	.40	.45
Single Family	.40	.45	.50	.55
Multi-Units	.45	.50	.60	.70
Mobile Homes (2)	.45	.50	.55	.65
Commercial (2) 80% Impervious	.70	.75	.80	.85
Industrial (2) 90% Impervious	.80	.85	.90	.95

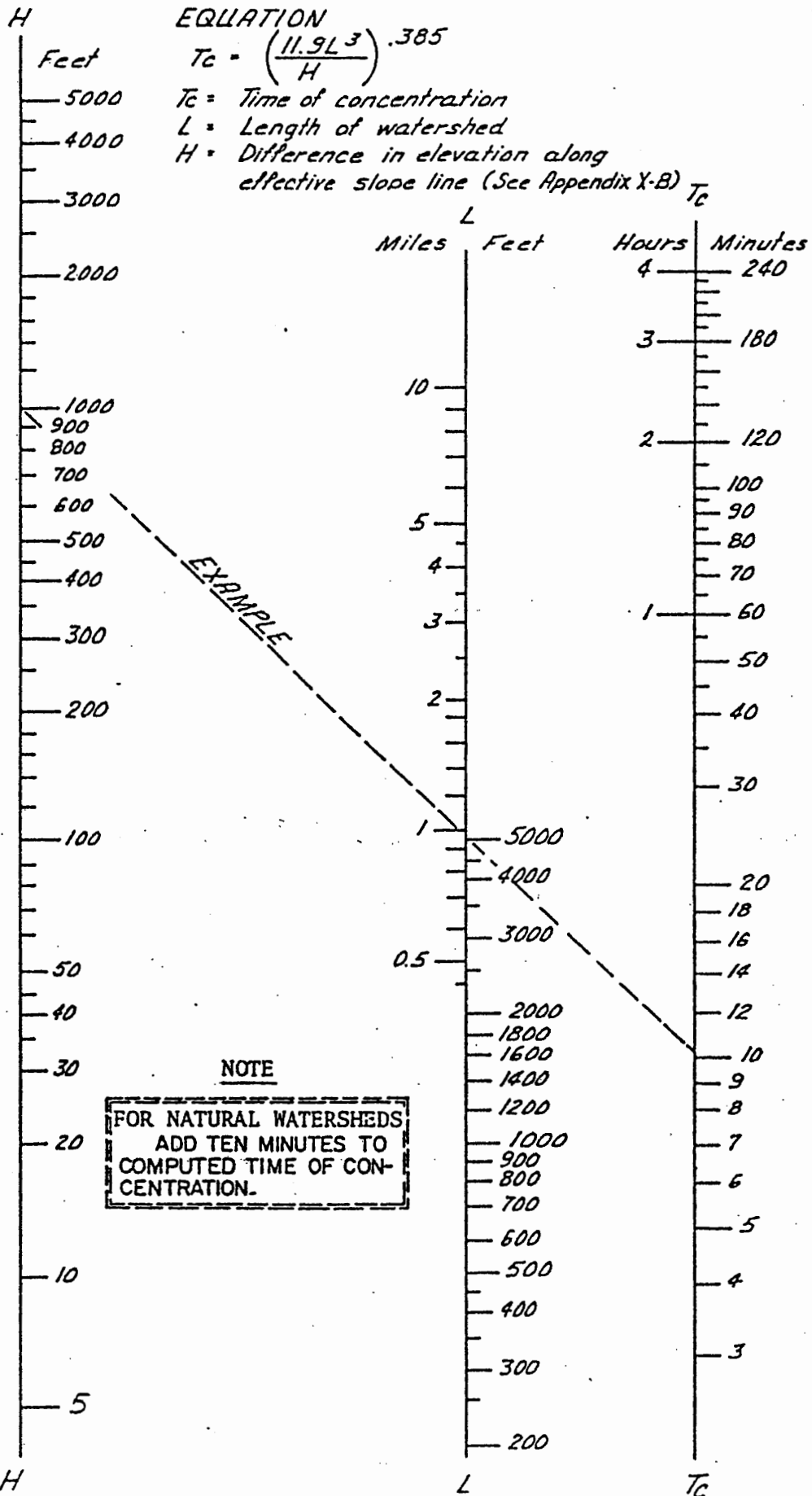
NOTES:

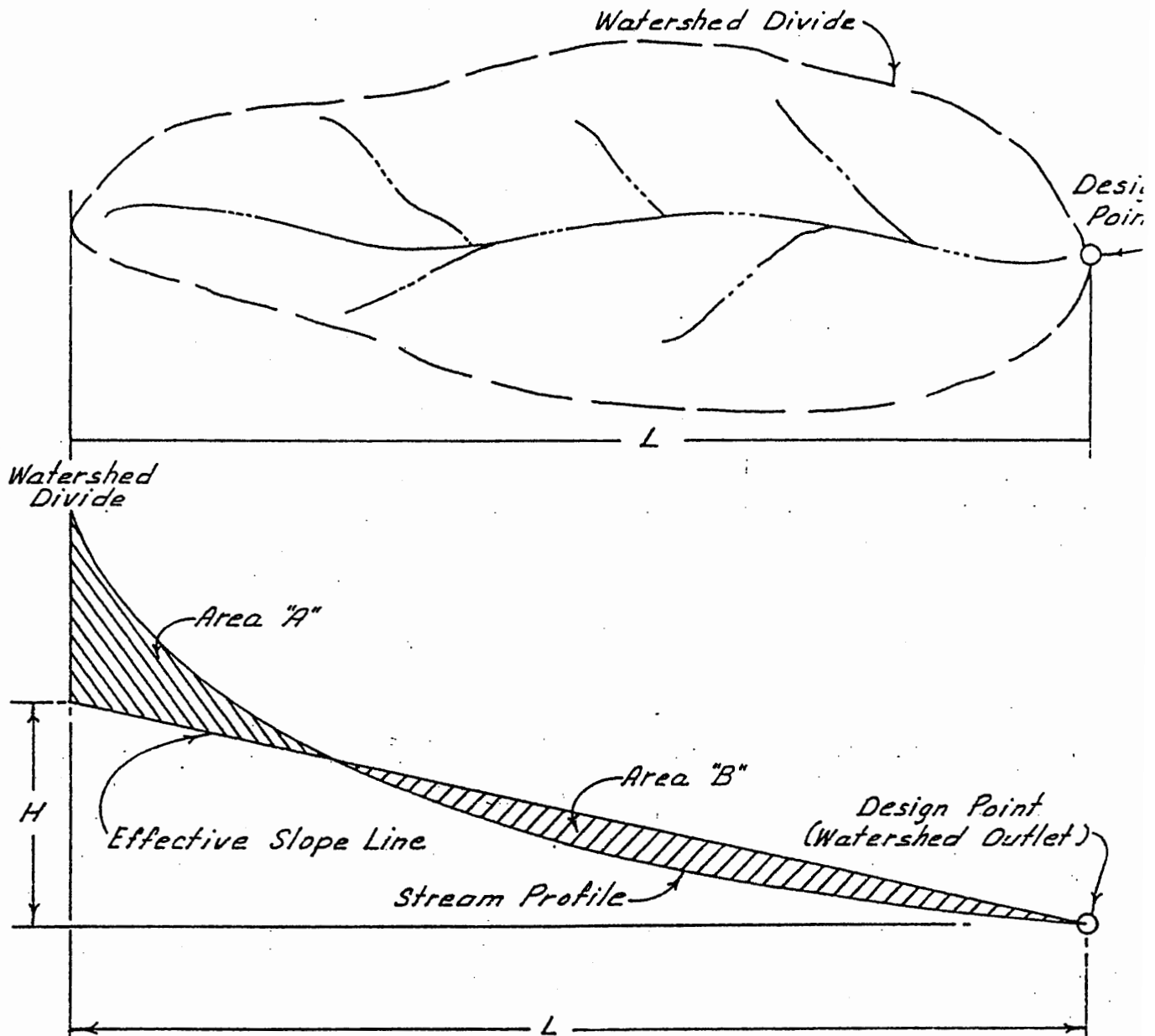
- (1) Obtain soil group from maps on file with the Department of Sanitation and Flood Control.
- (2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil group.

Actual imperviousness = 50%

Tabulated imperviousness = 80%

$$\text{Revised C} = \frac{50}{80} \times 0.85 = 0.53$$





$$\text{Area "A"} = \text{Area "B"}$$

SAN DIEGO COUNTY
DEPARTMENT OF SPECIAL DISTRICT SERVICES

DESIGN MANUAL

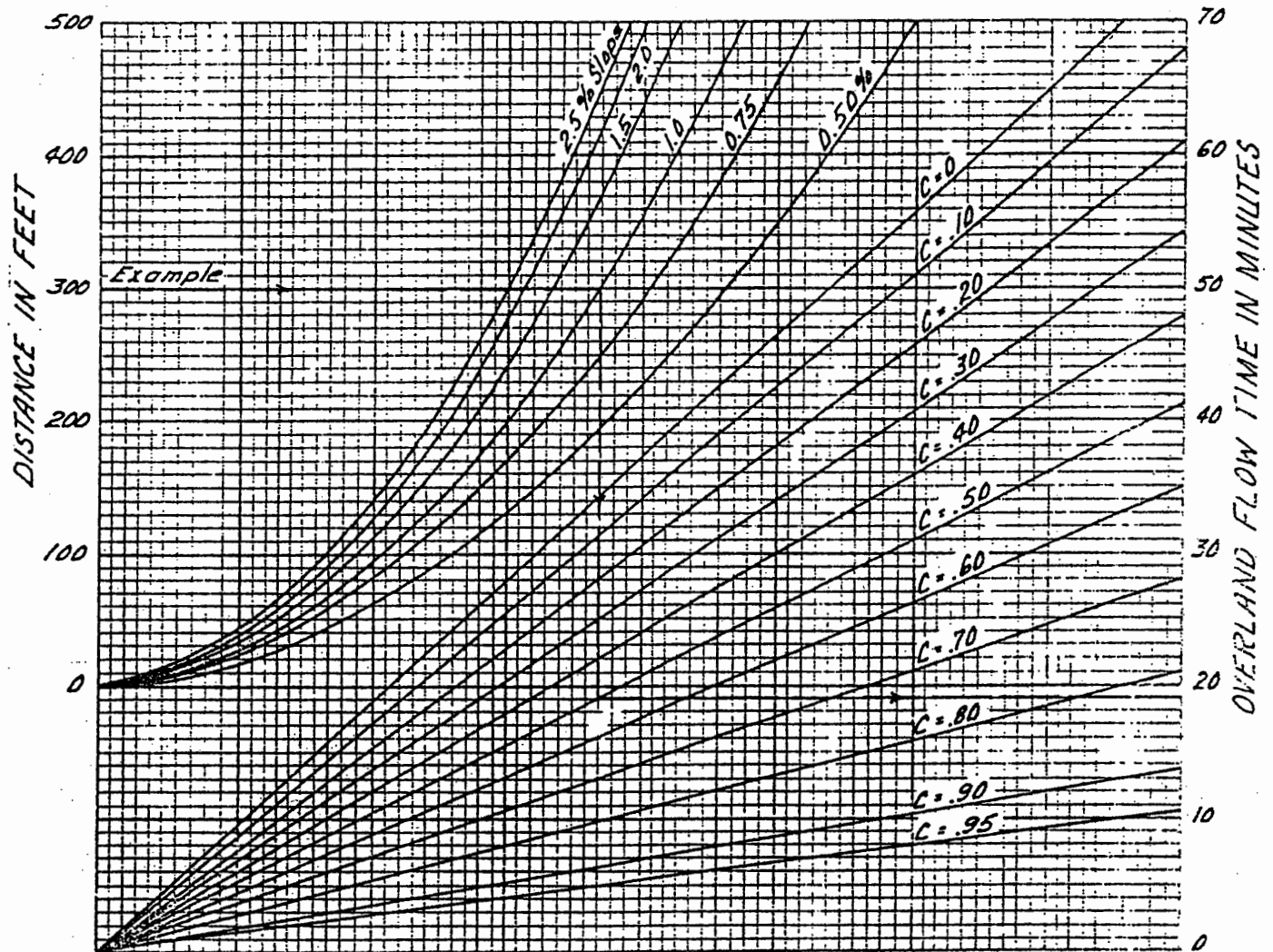
APPROVED B. H. Hoffman

COMPUTATION OF EFFECTIVE SLOPE
FOR NATURAL WATERSHEDS

DATE 12/1/69

APPENDIX X-3

URBAN AREAS OVERLAND TIME OF FLOW CURVES



Example:

Given: Length of Flow = 300 ft.

Slope = 1.0 %

Coefficient of Runoff, $C = .50$

Read: Overland Flowtime = 19 Minutes

SAN DIEGO COUNTY
DEPARTMENT OF SPECIAL DISTRICT SERVICES

DESIGN MANUAL

APPROVED

URBAN AREAS OVERLAND TIME
OF FLOW CURVES

DATE 12/1/69

APPENDIX X-C

APPENDIX “B”

By NBA Date 1/21/03 Client

Queen of Angels Sheet No. 1 Of 3

Checked

Date

Job

Job No. 75549

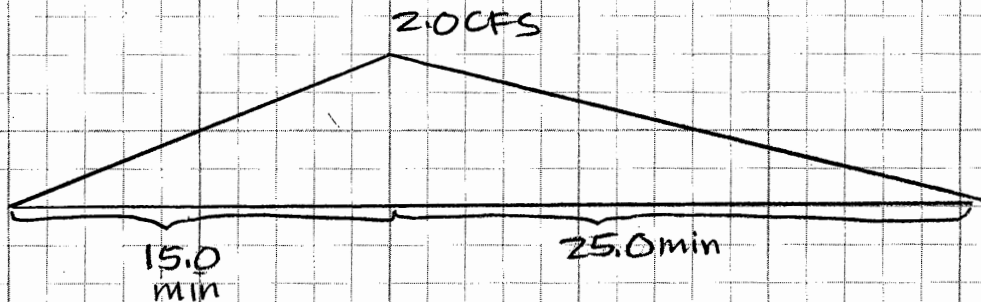
BASIN A ~ BASIN "AA"
(EXISTING) (DEVELOPED)

Q_{100} (EXIST.) ~ 20.0 CFS

Q_{100} (DEV.) ~ 22.0 CFS $\Rightarrow T_c = 15.8 \text{ min} \sim 15 \text{ min}$

$32.0 - 30.0 = 2.0 \text{ CFS}$ NEED TO BE
ATTENUATED

$T_r = 1.67 (T_c) = 1.67 (15.0) = 25.0 \text{ min}$



REQ. VOLUME = $\frac{1}{2} (2.0) (40 \times 60) = 2400 \text{ CF}$

SEE ATTACHED EXHIBIT
FOR DETAIL

PAD = 2084

PROP CATCH
BASIN

PROP. SD

TOPE 2082

I.O.W. 2078.5'

2' WALL

2:1

2:1

2080

2078

2076

2080

2:1

2070

2070

2065

2060

2070

VE SECTION OF
WOOD FENCE

PL

RIP RAP

PROP HEADWALL TO
DETENTION BASIN

OUTLET PIPE
AND RISER

860.66'

2070

PROPOSED
DETENTION
BASIN

By NBA Date 4/7/03 Client QUEEN OF ANGELS Sheet No. 3 Of 3

Checked _____ Date _____ Job _____ Job No. 75549

$A_1 \sim 105 \text{ FT}^2 @ \text{ELE} \sim 1970'$

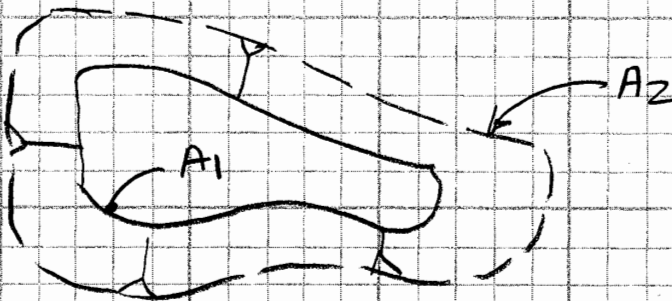
$A_2 \sim 1360 \text{ FT}^2 @ \text{ELE} \sim 1965'$

$A_3 \sim 1110 \text{ FT} @ \text{ELE} \sim 1964'$

} WITH 1.0'
FREE BOARD

$$A_{\text{AVG.}} = \frac{105 + 1110}{2} = 607.5 \text{ FT}^2 \sim 600 \text{ FT}^2$$

VOLUME ACT. $\sim 600 \times 4.0 \sim 2400 \text{ CF} \sim \text{OK}$

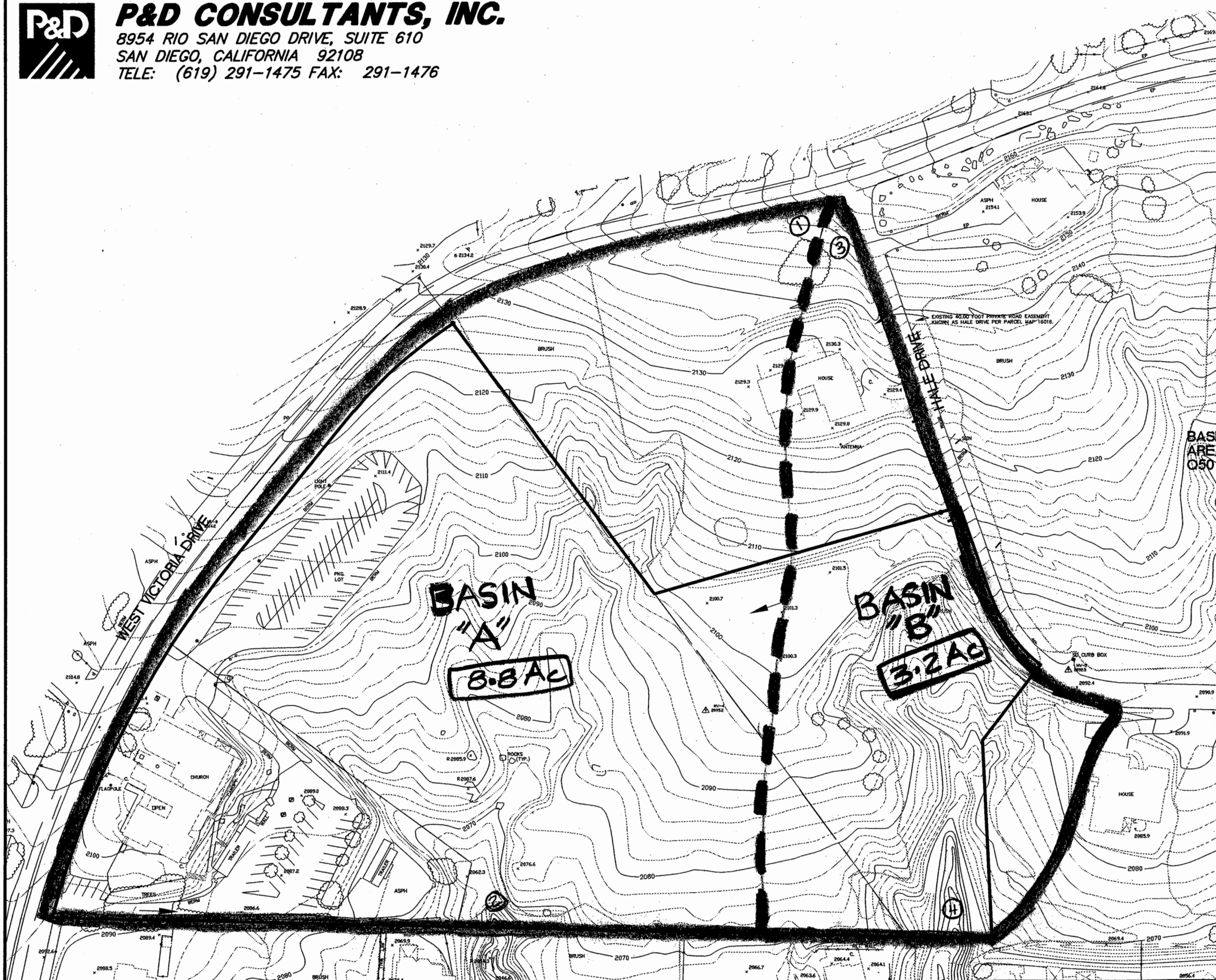


EXHIBITS

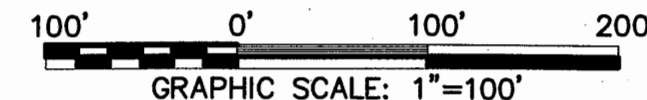


P&D CONSULTANTS, INC.

8954 RIO SAN DIEGO DRIVE, SUITE 610
SAN DIEGO, CALIFORNIA 92108
TELE: (619) 291-1475 FAX: 291-1476



SCALE: 1" = 100'



**ONSITE DRAINAGE
EXHIBIT**

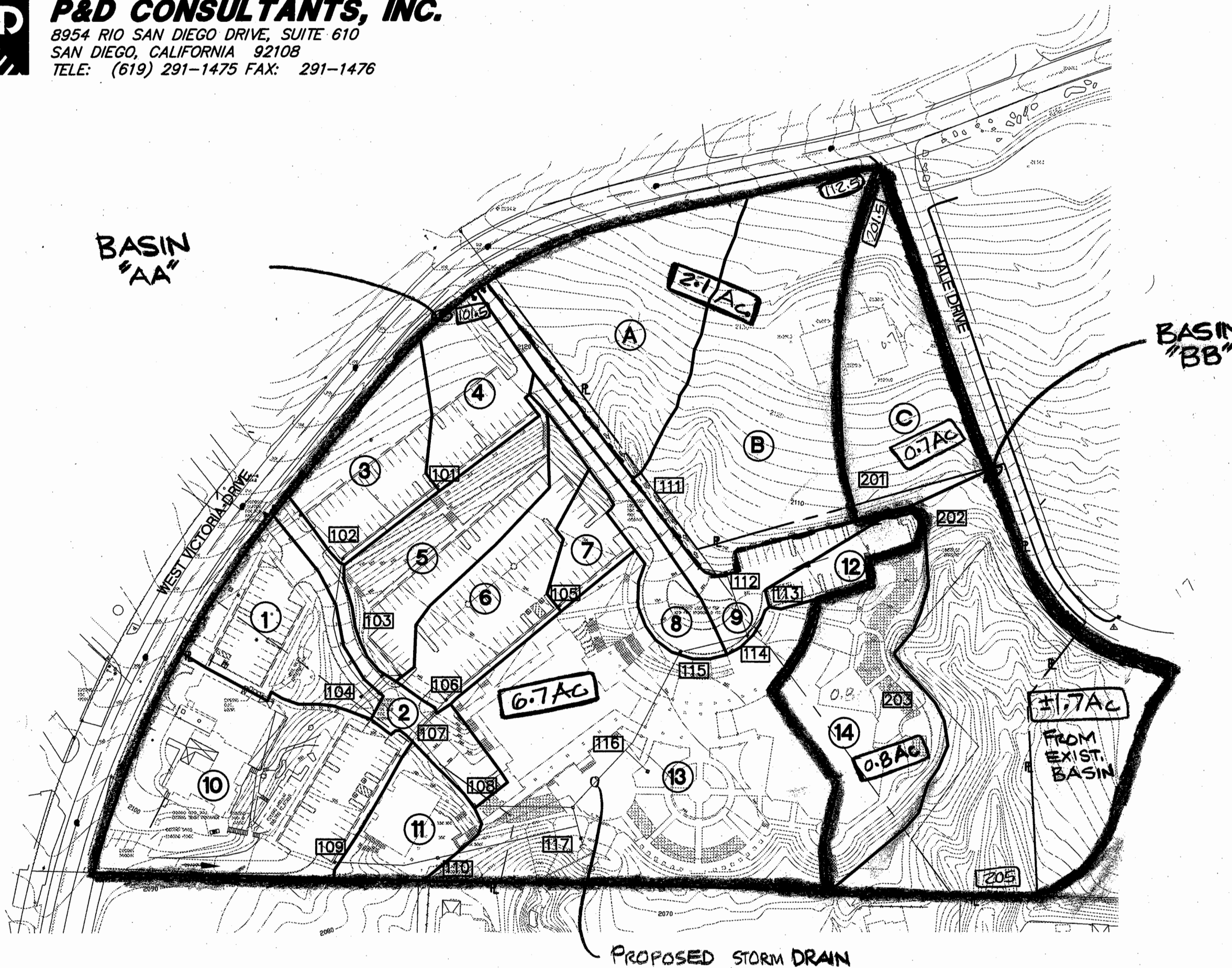
**EXISTING
CONDITION**

**QUEEN OF ANGELS
CATHOLIC CHURCH
ALPINE, CALIFORNIA**



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SCALE: 1" = 100'



GRAPHIC SCALE: 1"=100'

**ONSITE DRAINAGE
EXHIBIT**

**DEVELOPED
CONDITION**

**QUEEN OF ANGELS
CATHOLIC CHURCH
ALPINE, CALIFORNIA**